

EXHIBIT 1

04645.0734

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Michael F. Scalise, Esq.

Name

Signature

Date of Signature

6/16/03

copy #1

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of : Gan et al.
Serial No. : 10/859,558
Filed : May 17, 2001
For : Control of Cell Swelling
By the Proper Choice of
Carbon Monofluoride (CF_x)
Cathode Materials In High
Rate Defibrillator Cells
Examiner : L. Weiner
Art Unit : 1745

SECOND SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT
PURSUANT TO 37 CFR 1.56

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Commissioner For Patents
P.O. Box 1450
Alexandria, VA 22313-1450

1. Applicants submit herewith patents, publications or other information of which they are aware, which they believe may be material to the examination of this application and in respect of which there may be a duty to disclose in accordance with 37 CFR 1.56.

-2-

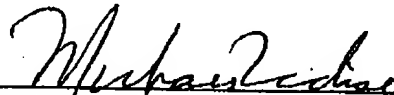
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The filing of this Information Disclosure Statement (IDS) shall not be construed as a representation that a search has been made (37 CFR 1.56(g)), an admission that the information cited is, or is considered to be, material to patentability or that no other material information exists.

The filing of this IDS shall not be construed as an admission against interest in any manner (Notice of Jan. 9, 1992, 1135 O.G. 13-25, at 25).

2. Attached is Form PTO-1449. Legible copies of all items listed accompany this IDS.
3. The fee set forth in 37 CFR 1.17(p) for submission of an Information Disclosure Statement is enclosed herewith.
4. The person making this statement is the agent who signs below, who makes this statement on the information supplied by the inventors and the information in the agent's file.

Respectfully submitted,

By 
Michael F. Scalise
Reg. No. 34,920

WILSON GREATBATCH TECHNOLOGIES, INC.
10,000 Wehrle Drive
Clarence, New York 14031
(716) 759-5810
June 16, 2003

Please type a plus sign inside this box +

PTO/SB/08A(08/00)

Approved for use through 10/31/2002, OMB 0651-0031

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Application Number	10/859,558
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Filing Date	May 17, 2001
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First Named Inventor	Gan et al.
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Group Art Unit	1745
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Examiner Name	L. Weiner
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Attorney Docket Number	04645.0734
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Sheet

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U.S. PATENT DOCUMENTS

[illegible]

FOREIGN PATENT DOCUMENTS

[illegible]

**Examiner
Signature**

Date
Considered

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

1 Unique citation designation number. 2 See attached Kinds of U.S. Patent Documents. 3 Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). 4 For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. 5 Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. 6 Applicant is to place a check mark here if English language Translation is attached.

PTO/SB/17 (11/01) Approved for use through 10/31/2002; OMB 0651-0032

**FEE TRANSMITTAL
for FY 2002**

Patent Fees are subject to annual revision.

G Applicant claims small entity status. See 37 CFR 1.27.

TOTAL AMOUNT OF PAYMENT (\$180.00)

Application Number 10/859,558

Filing Date May 17, 2001

First Named Inventor Gan et al.

Examiner Name L. Weiner

Group/Art Unit 1745

Attorney Docket Number 04645.0734

METHOD OF PAYMENT (check all that apply)

O Check • Credit Card G Money Order G Other G None

• Deposit Account: Deposit Account Number: 502460

Deposit Account Name:

The Commissioner is hereby authorized to (check all that apply)

G Charge fee(s) indicated below

• Charge any fee deficiencies or credit any overpayments

G Charge any additional fees during pendency of this application.

G Charge fees indicated below, except for the filing fee to the above-identified deposit account

FEE CALCULATION**1. BASIC FILING FEE**

Large Entity Small Entity

Fee Fee Fee Fee

Code (\$) Code (\$) Fee Description Fee Paid

101 750 201 375 Utility filing fee \$

106 330 206 165 Design filing fee \$

107 520 207 260 Plant filing fee \$

108 750 208 375 Reissue filing fee \$

114 160 214 80 Provisional filing fee \$

SUBTOTAL (1)

2. EXTRA CLAIM FEES FOR UTILITY/REISSUE

Extra Fee from

Claims below

Total Claims // -20** = // x // = \$

Independent Claims // - 3** = // x // = \$

Multiple dependent // x // = \$

Large Entity Small Entity

Fee Fee Fee Fee

Code (\$) Code (\$) Fee Description Fee Paid

103 18 203 9 Claims in excess of 20 \$

102 84 202 42 Independent claims in excess of 3 \$

104 280 204 140 Multiple dependent claim if not paid \$

109 84 209 42 **Reissue independent claims over original patent \$

110 18 210 9 **Reissue claims in excess of 20 and over original patent \$

SUBTOTAL (2)

SIGNATURE: Michael F. Scallio

Reg. No. 34,920

DATE: June 16, 2003

Telephone: (716) 759-5810

FEE CALCULATION (continued)**3. ADDITIONAL FEES**

Large Entity Small Entity

Fee Fee Fee Fee

Code (\$) Code (\$) Fee Description Fee Paid

105 130 205 65 Surcharge - late filing fee or oath \$

127 50 227 25 Surcharge - late provisional filing fee or cover sheet \$

139 130 139 130 Non-English specification \$

147 2,520 147 2,520 For filing a request for ex parte reexamination \$

112 920* 112 920* Requesting Publication of SIR prior to Examiner Action \$

113 1,840* 113 1,840* Requesting Publication of SIR after Examiner Action \$

115 110 215 55 Extension for reply within first month \$

116 410 216 205 Extension for reply within second month \$

117 930 217 465 Extension for reply within third month \$

118 1,450 218 725 Extension for reply within fourth month \$

128 1,970 228 985 Extension for reply within fifth month \$

119 320 219 160 Notice of Appeal \$

120 320 220 160 Filing a brief in support of an appeal \$

121 280 221 140 Request for oral hearing \$

138 1,510 138 1,510 Petition to institute a public use proceeding \$

140 110 240 55 Petition to revive - unavoidable \$

141 1,300 241 650 Petition to revive - unintentional \$

142 1,300 242 650 10 advance copies \$

143 470 243 235 Utility issue fee (or reissue) \$

144 630 244 315 Design issue fee \$

122 130 122 130 Plant issue fee \$

123 50 123 50 Petitions to the Commissioner \$

126 180 126 180 Processing fee under 37 CFR 1.17(g) \$

581 40 581 40 Submission of Information Disclosure Statement \$

146 750 246 375 Recording each patent assignment per property (times \$

149 750 249 375 number of properties) \$

179 750 279 375 Filing a submission after final rejection(37 CFR 1.129(a)) \$

169 900 169 900 For each add'l invention to be examined(37 CFR 1.129(b)) \$

179 750 279 375 Request For Continued Examination (RCE) \$

169 900 169 900 Request for Expedited Examination of a design appln. \$

Other fee (specify) \$

*Reduced by basic filing fee paid

SUBTOTAL (3) \$180

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SERIAL NO. 10/859,558 CASE NO. _____FILED: May 17, 2001 CLIENT CASE NO. 04645.0734APPLICANT(S): Gan et al.THE PATENT AND TRADEMARK OFFICE MAIL ROOM DATE STAMP
HEREON ACKNOWLEDGES RECEIPT OF THE FOLLOWING ITEMS:

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| <input type="checkbox"/> Assignment | <input checked="" type="checkbox"/> Info. Disclosure Statement |
| <input type="checkbox"/> Small Entity Declaration | <input type="checkbox"/> Appeal |
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| <input type="checkbox"/> Amendment | <input type="checkbox"/> Issue Fee Transmittal |
| <input type="checkbox"/> Deposit Account | <input type="checkbox"/> Maintenance Fee Transmittal |
| <input checked="" type="checkbox"/> Fees \$ <u>180.00</u> (check) | |
| <input checked="" type="checkbox"/> Other <u>Fee transmittal form, Form 1449 with cited patent,</u> | |
| <u>credit-card form</u> | |
| Mailed <u>June 16, 2003</u> | Atty <u>M. Scalise</u> Secretary <u>R. Contella</u> |

SERIAL NO. 10/859,558 CASE NO. _____
FILED: May 17, 2001 CLIENT CASE NO. 04645.0734APPLICANT(S): Gan et al.THE PATENT AND TRADEMARK OFFICE MAIL ROOM DATE STAMP
HEREON ACKNOWLEDGES RECEIPT OF THE FOLLOWING ITEMS:

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| <input type="checkbox"/> Assignment | <input checked="" type="checkbox"/> Info. Disclosure Statement |
| <input type="checkbox"/> Small Entity Declaration | <input type="checkbox"/> Appeal |
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| <input type="checkbox"/> Deposit Account | <input type="checkbox"/> Maintenance Fee Transmittal |
| <input checked="" type="checkbox"/> Fees \$ <u>180.00</u> (check) | |
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| <u>credit-card form</u> | |
| Mailed <u>June 16, 2003</u> | Atty <u>M. Scalise</u> Secretary <u>R. Contella</u> |

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I hereby certify that this Correspondence is being
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1450, Alexandria, VA 22313-1450, on September 12,
2003, via fax phone number 703-872-9311.

Michael F. Scalise

Name


SignatureSeptember 12, 2003

Date of Signature

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of : Gan et al.
Serial No. : 09/859,558
Filed : May 17, 2001
For : Control Of Cell Swelling By
The Proper Choice of Carbon
Monofluoride (CF_x) Cathode
Material In High Rate
Defibrillator Cells
Examiner : L. Weiner
Group Art Unit : 1745

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

DECLARATION UNDER 37 CFR 1.131

We, Hong Gan, Sally Ann Smesko and Esther S. Takeuchi,
the inventors of the subject matter of the above-referenced
application, declare:

04645.0734

- 2 -

1. That the purpose of this declaration is to establish completion of the invention claimed in this application in the United States at a date prior to April 27, 2000, the effective date of U.S. Patent No. 6,551,747 to Gan.
2. That we are the inventors of the subject matter disclosed and claimed in the above-identified patent application filed May 17, 2001.
3. That the claimed invention was conceived and reduced to practice prior to April 27, 2000, as evidenced by the six page Patent Disclosure attached as Exhibit 2.
4. That from this Patent Disclosure, it can be seen that the claimed invention directed to an electrochemical cell having an anode; a cathode of a first fluorinated carbon of a first energy density and a first rate capability and a second cathode active material of a second energy density and a second rate capability, wherein the first energy density of the first fluorinated carbon is greater than the second energy density while the first rate capability is less than the second rate capability of the second cathode active material; a cathode current collector comprising spaced apart major sides with the first fluorinated carbon positioned proximate one of the major sides and the second cathode active material contacting the other major side of the cathode current collector; and an electrolyte activating the anode and the cathode, wherein the fluorinated carbon is characterized as having been synthesized from a fibrous carbonaceous material having

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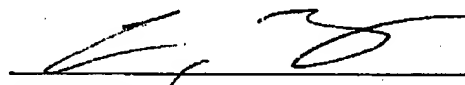
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sufficient spacing between graphite layers to substantially restrict expansion due to solvent co-intercalation, was reduced to practice before the effective date of the Gan patent cited by the Examiner in the office action dated July 28, 2003.

5. As a person signing below:

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Inventors' Signatures


Hong Gan

~~Sept. 2~~
Date: August , 2003


Sally Ann Smesko

Date: September 9, 2003

~~Sept 4~~
Date: August , 2003


Esther S. Takeuchi

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EXHIBIT 2*provisional application
Serial No. 60/205,361,
filed 5/18/00***Invention Disclosure**

Title: Control of Cell Swelling by the Proper Choice of Carbon Monofluoride (CFx)
Cathode Materials in High Rate Defibrillator Cells

Date of Invention: Dec. 17, 1999

Inventors: Hong Gan, Sally Smesko and Esther Takeuchi
Wilson Greatbatch Ltd. USA

Field of Invention

The current invention addresses the use of CFx prepared from highly structured carbon precursors. It relates to an application and design of a defibrillator battery and in particular a high capacity lithium battery designed for high rate discharge application in which the battery contains "SVO-Current collector-CFx-Current collector-SVO" sandwiched cathode configuration.

Description of the Prior Art

In a previous patent disclosure (titled: Sandwich Cathode Design for High Capacity Alkali Metal Cell with High Discharge Rate Capability), a sandwiched cathode design in a high rate cell has been discussed. The concept was to construct a lithium cell containing the sandwich cathode which was composed of a first cathode material (high energy density materials such as CFx, Ag₂O₂, SVO, etc.) sandwiched between two layers of current collector, which was again sandwiched between two layers of the second cathode material (with high power capability, such as SVO, CSM, MnO₂, etc.). Significantly higher capacities were obtained from cells with sandwiched SVO/CFx/SVO cathode design relative to that of cells using only SVO material in a conventional cathode design. In addition, the higher capacity of the cell has been achieved without the sacrificing the cell's power capability. Therefore cells constructed with this new cathode design can be a very good candidate as a power source for the implantable cardiac defibrillators.

Other than cell capacity, one concern for implantable medical device application is the cell swelling during discharge. This must be considered for the device design so that enough void space is left for this cell volume change in order to prevent damage of the device circuitry. The more swelling of the cell, the more void space may have to be reserved, the larger the device total

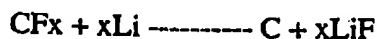
volume may be. In the field of implantable biomedical devices small total device volume is desired. Thus it is desirable to minimize or eliminate the existence of cell swelling which will allow more efficient design and the safe use of the device.

CFx material serves as a cathode material for low-weight lithium cells. It has been observed that when Li/CFx cells, with CFx synthesized from petroleum coke, are discharged under high currents, significant cell swelling was observed. This cell swelling phenomenon was, however, not observed for cells discharged under low current. Since in the application of the implantable defibrillator, the cells were periodically pulse discharged under very high current density (23.2 mA/cm² or higher for example), the application of the same CFx material in the defibrillator cell is thus posted a potential cell swelling issue. We found that the swelling of cells containing SVO/CFx/SVO sandwich cathode can be significantly minimized by choosing CFx materials synthesized from proper starting carbon materials. CFx synthesized from carbon fiber, and potentially from mesophase carbon microbeads (MCMB) or expanded graphite are identified as the best CFx materials which will induce minimum cell swelling in the cells containing CFx as part of the cathode material relative to that synthesized from graphite or petroleum coke.

Summary of the Invention

The object of the present invention is to minimize or eliminate the swelling of lithium cells that contain CFx as part of the cathode material under high rate discharge. A further object of this invention is to identify proper CFx materials which can be synthesized from carbon precursors with special structural characteristics. We have found that the above objectives can be achieved by using CFx material synthesized from carbon fiber. The same effect could also be achieved by synthesizing the material from MCMB or expanded graphite.

CFx cathode materials retain the layered structure of the carbon precursor. Upon discharging in lithium cells, lithium ion was intercalated into the layered structure to react with fluorine (which has been attached to the carbon backbone either covalently or ionically) to form lithium fluoride. At the same time, the carbon with the layered structure was formed. The cell reaction is shown below:



It is well known that lithium ion exists in the electrolyte mostly as a solvent solvated ion. When it was intercalated into the carbon layers of CFx under discharge, solvent co-intercalation is

also thought to exist. It is hypothesized that the solvent which co-intercalated into the carbon layered structure forms a solvated reaction intermediate. This intermediate would cause the destruction of the carbon structure and resulted in the expansion of the discharged CFx electrode. Under high rate discharge, more solvent molecules will co-intercalate into the layered structure within short period of time which will create high concentration of solvent molecules locally and in turn will cause more layered structure destruction or expansion at the local region. Therefore, in order to minimize or eliminate cell swelling, the layered carbon destruction or expansion due to the solvent co-intercalation should be minimized.

The goal can be achieved by modifying the carbon microstructure of the CFx material. Materials with the following structures are proposed: ① carbon fiber with annual ring layered structure where graphite crystallite edges exposed only on the cross section, ② carbon fiber with radial layered structure where all of the fiber surface has the graphite crystallite edges exposed, ③ MCMB with radial-like texture where all of the surface of a MCMB has the graphite crystallite edges exposed, finally the ④ expanded graphite which has the distance between the carbon layers already increased such that the further expansion of the graphite due to solvent co-intercalation will be minimized.

The benefit of using above carbon materials as precursor for CFx synthesis to minimize cell swelling is based on their structure. Since the layered structure of carbon is expected to be maintained after fluorination, the effect of carbon structure on the solvent co-intercalation and on the swelling of the carbon particles upon discharge will become very significant. For carbon fiber with annual ring structure, the swelling is most likely happen in the dimension perpendicular to the axis due to the d spacing increase between the graphite ring layers. However, the increase of d spacing between the graphite layers should be limited. The strength of the carbon-carbon bonds within the graphite layer will prevent the further expansion of the graphite ring. In the case of carbon fiber and MCMB with radial like textures, the expansion of the carbon materials due to the co-intercalation of solvent are expected to be small due to the physical restraint of the carbon layered structure. When solvent molecules were intercalated into the carbon layers, the increased d spacing between the graphite layers will generate expansion tension directed along parallel to the carbon surface. Thus, unless the carbon fiber or MCMB three dimensional structure break up, the carbon particles are less likely to be swelled. As a results the cell swelling phenomenon will be minimized. In the case of expanded graphite, since the d spacing of the graphite layers is already increased, it will allow more solvent molecule to be co-intercalated before the further increase of d spacing between the carbon layers. In other words, CFx synthesized from expanded graphite should allow higher discharge rate than that of CFx synthesized from regular graphite before

cathode swelling occurs. In principle, any carbon material with structures which restrict the increase of d spacing between the graphite layer can be considered good precursor for CFx synthesis. The use of CFx synthesized from these carbon materials is beneficial to achieve cell swelling minimization or elimination.

Detailed Description of the Preferred Embodiments

In the present invention, the anode used is lithium metal and the cathode is the transition metal oxide $\text{Ag}_2\text{V}_4\text{O}_{11}$ (SVO) and Fluorinated Carbon (CFx). The cathodes had sandwich structure with CFx sandwiched between two layers of cathode current collectors which is again sandwiched between two layers of SVO layers. Electrolyte for the cell is 1.0M LiAsF_6 in one to one volume ratio of propylene carbonate (PC) and 1,2-dimethoxy-ethane (DME) plus 0.05M dibenzyl carbonate (DBC).

Example I

For all the cells, lithium anode material was pressed on nickel current collector screen. The cathodes were pressed on two layers of titanium current collector screen with the configuration of SVO-screen-CFx-screen-SVO. A prismatic cell stack assembly configuration with two layers of microporous membrane polypropylene separator sandwiched between the anode and cathode was prepared. The electrode assembly was then hermetically sealed in a stainless steel casing in a case negative configuration and activated with the electrolyte. The theoretical capacity of the cell is 2.645 Ah.

Two cells were constructed with CFx material synthesized from petroleum coke (group 1). Four cells were constructed with CFx synthesized from carbon fiber (group 2). One cell from group 1 and one cell from group 2 were accelerated pulse discharged. Pulse trains with four 10 second 2 Amp current pulses and 15 second rest between the pulses were applied every 30 minutes. The capacities delivered at three voltages cut off are summarized in Table 1.

Group	Capacity at Cut Off (mAh)			Efficiency at Cut Off (%)		
	2.0V	1.7V	1.5V	2.0V	1.7V	1.5V
1	1816	2069	2274	68.7	78.2	86.0
2	1967	2205	2320	74.4	83.4	87.7

The data in the above table demonstrate that group 2 cell with CFx synthesized from carbon fiber delivered more capacities and higher efficiencies at all three voltages cut off than cells constructed with CFx synthesized from petroleum coke. The cell thickness before and after discharge was also measured (see Figure 1).

To check the swelling characteristics of these cells, one cell from group 1 and three cells from group 2 were discharged the same way as described above except only 50% theoretical capacity was removed. The cell thickness was measured before and after the discharge test. The cell thickness data are summarized in Figure 1. As shown in Figure 1, group 1 cells swelled significantly. The larger the DOD, the more the cell swelling. In contrary, group 2 cells exhibited fairly insignificant swelling throughout the discharge.

Inventors Signature:

Date:

Laboratory Notebook Page:

C. Y.
Daigian Somo
Esther Galli

R 339-66-1

R 373-18, 19, 33, 42-44, 48, 86-89

